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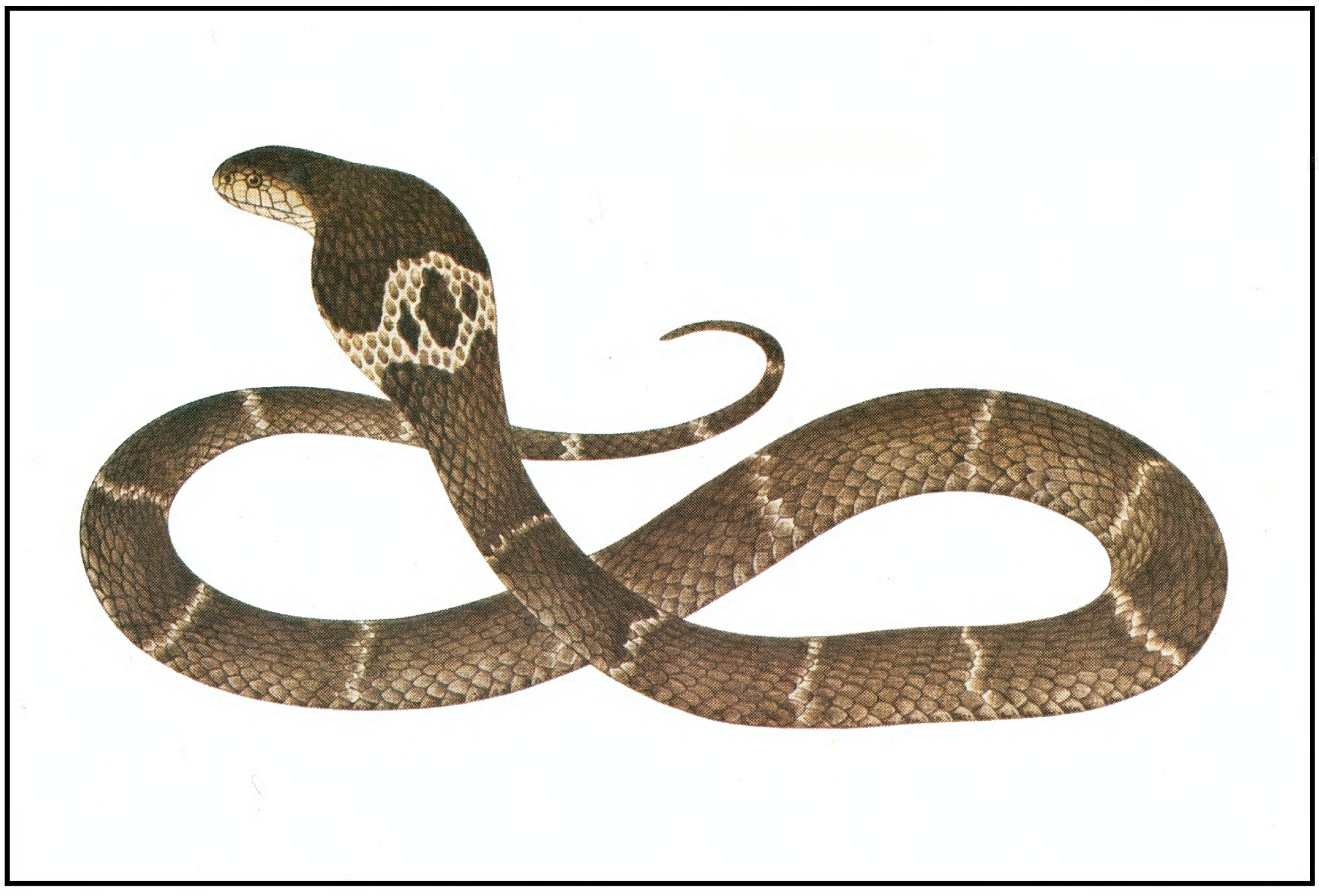

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Account of a Non-native *Malayopython reticulatus* in Puerto Rico

Justin M. Elden [1]*, Joey Picone [1], Michael Buontempo [2], Kameron Burgess [1], Hari Parasu [1], Fabián A. Feliciano-Rivera [3] and Dane Conley [4]

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The reticulated python, *Malayopython reticulatus* (Schneider, 1801) stands as one of the largest snake species in terms of both length and mass. Native to the Southeast Asian countries of Bangladesh, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam, it thrives across a diverse array of ecosystems (Groombridge and Luxmoore, 1991; Deuve, 1970; Auliya et al., 2002; O'Shea and Lazell, 2008; Das, 2010; Barker et al., 2018). Habitat includes dense rainforests, mangrove swamps, open woodlands, and river valleys with frequent proximity to riparian zones (Auliya, 2006).

Due to its extensive distribution and adaptability, the reticulated python assumes a critical ecological role as an apex predator, exercising regulatory control over prey populations and contributing significantly to ecosystem equilibrium within its native habitat (Shine et al., 1999; Fredriksson, 2005). This species predominantly preys upon small mammals, birds, and occasionally larger mammals such as deer and primates. Its adaptable nature often leads it to human settlements, where it thrives feeding on rodents, pets, and small livestock (Natusch et al., 2019). Sexual dimorphism is evident, with females typically attaining sizes exceeding those of males by more than 40% (Shine et al., 1998). Large female facilitates large clutch sizes, a mean of 20 eggs per clutch, with snout–vent length (SVL) positively correlated with clutch sizes (Natusch et al., 2019).

Reptiles, especially snakes, are highly sought after in both the legal and illegal exotic pet trade (Cronin et al., 2022). In the case of larger species, such as *M. reticulatus*, this may be due to their impressive size and coloration. As wildlife trade increases, opportunities for released or escaped captive animals to establish in novel environments are created (McFadden et al., 2017). The chances for said animal to become established in a novel environment is increased when it is released in similar habitat to that of the native range with limited predation risk. Although commonly kept as exotic pets, instances of reticulated pythons observed beyond their natural range, notably in the U.S., have yet to yield conclusive evidence of established reproductive populations. Isolated observations of *M. reticulatus* have been reported in Puerto Rico since 2012 (USFWS, 2012). In 2019, reports emerged from the U.S. Territory of Puerto Rico indicating the presence of *M. reticulatus* along the José de Diego Expressway (Puerto Rico Highway 22) near Arecibo, with specimens also documented in the western and southern regions of the island, including one measuring 5.5 m in length. Subsequent observations have mostly been limited to social media platforms, news outlets, and citizen science databases. Eleven wild-caught individuals were donated to the University of Puerto Rico at Mayagüez (Almeda Castro et al., 2023), providing evidence of both adult and neonatal reticulated pythons in Puerto Rico, and suggesting successful reproduction in the wild. This is supported via genetic evaluations of animals, which suggest that they are likely of Sumatran origin (Rivera-Ocasio and Puente-Rolón, 2023). Reports have increased since 2019, raising concern that the Puerto Rico population may be increasing. As late as 2009 there were no known introduced populations of *M. reticulatus* outside of Asia (Reed and Rodda, 2009).

Boa constrictor is another large constricting species that has become an invasive species on the island, successfully reproducing and establishing itself on the island of Puerto Rico (Reynolds et al., 2013; Almeda Castro et al., 2023), suggesting that Puerto Rico is a suitable location for the establishment of non-native constricting snake species.

On 15 January 2024, the authors commenced efforts to locate wild *M. reticulatus* within Puerto Rico's Bayamon municipality. Weather conditions consisted of clear skies and daytime temperatures reaching 29.4°C before dropping to 23.9°C an hour after dusk. During this time 12 search hours (six people / two hours each) were carried out on foot around dilapidated structures and dense vegetation near the vicinity of a large body of water bordering the Bayamon and Toa Alta municipalities. Debris and trash were flipped around abandoned structures. During this time three *Rattus rattus* were encountered. These efforts produced no snakes or signs of python activity, resulting in the search strategy transitioning to traversing roads surrounding the sizable freshwater body, employing a consistent route beginning at 00:00. On this predetermined route, 34 km were driven until 01:43, when an adult female *M. reticulatus* was observed crossing a road in a northwestern direction (Figure 1). The ambient temperature of the snake's body was recorded at 22.5°C, closely mirroring the 22.3°C of the road surface. The SVL was measured at 311 cm while the total length was 361 cm. The snake

Figure 1.

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4. Virginia Tech, 1015 Life Science Circle, Blacksburg, VA 24061.

Figure 2.

Figure 3.

was sexed based upon tail length. The snake was evaluated as being in healthy body condition with a lack of visible abrasions, external parasites, or wounds. The animal superficially resembled individuals of Southeast Asian origin. Based on palpating, no developing follicles, ova, or food boluses were present. The habitat's flora was made up of a variety of species including various tall grasses, *Spathodea campanulata*, *Hedera helix* and *Carica papaya* (Figure 2). Seventy meters to the north of the capture point can be found a large housing complex, as well as various businesses and community centers.

The snake was turned over to the University of Puerto Rico at Mayagüez for further investigation after photos were taken for documentation purposes (Figure 3). The following evening an additional 36 km were driven on the same route between 19:00 and 22:00, with no pythons encountered. We note that many feral cats, chickens, dogs, and rodents were encountered in this area. Based on the wide availability of prey, tropical forest habitat, and limited predators, *M. reticulatus* may continue to survive, and reproduce, in this region of Puerto Rico.

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Minutes of the CHS Board Meeting, July 16, 2024

A virtual meeting of the CHS board of directors via Zoom conference video/call was called to order at 7:30 P.M. Board members Mike Dloogatch and Kyle Houlihan were absent. Minutes of the June 18 board meeting were read and accepted.

Officers' Reports

Treasurer: Rich Crowley offered thoughts on replacing the storage unit we currently rent with a more reasonably priced unit farther out in the suburbs. Rich also reported on his progress in moving the library to the Elgin Math and Science Academy (EMSA).

Vice-president: A motion to appoint Caitlin Monesmith as as vice-president in place of the outgoing VP Amelia Pollock starting on August 1, 2024, passed unanimously.

Sergeant-at-arms: Tom Mikosz reported attendance of 27 at the Junior Herpers meeting and 15 at the general meeting in June.

Committee Reports

Junior Herpers: Caitlin reported that at the August meeting the kids will give small presentations; shyer kids can do a short video at home to present.

Old Business

We need to inform our contacts at the Notebaert regarding our moving the general meetings to EMSA.

The meeting adjourned at 8:55 P.M.

Respectfully submitted by Gail Oomens

Minutes of the CHS Board Meeting, August 13, 2024

A virtual meeting of the CHS board of directors via Zoom conference video/call was called to order at 7:30 P.M. Board members Gabrielle Evans, Kyle Houlihan, Tom Mikosz and Margaret Ann Paauw were absent. Dan Alexander and Bob Hilger also attended. Minutes of the July 16 board meeting were read and accepted with changes.

Dan Alexander is excited to host the CHS meetings at the Elgin Math and Science Academy (EMSA). School started on August 19 and they will be having all-school assemblies every Friday morning. Maybe we can have some members come out to introduce a few reptiles (30 minutes max).

Dan will work with Rich Crowley and Caitlin Monesmith on a "dry run" testing of the remote interface to ensure that we have no problems at the September 11 board meeting and the September 18 general meeting at EMSA.

Officers' Reports

Treasurer: Rich Crowley reported that the July financial statements were not yet complete.

Media secretary: Caitlin has taken over a lot of the posting for social media. Most engagement is still through Facebook. She would like help from other members for content. We should post online regarding board positions and what they entail to see if we can get more members involved.

Committee Reports

Shows: Sixth Annual Pet Event, Bartlett Gazebo Park, Bartlett, Illinois, Saturday, September 7.

Junior Herpers: Caitlin reported that the main three families that attend regularly will likely give presentations on their own reptiles at the August meeting.

Old Business

Tour of The Grove for CHS members will be on Saturday, August 31.

The meeting adjourned at 8:34 P.M.

Respectfully submitted by Gail Oomens

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Notes on the Herpetofauna of Mexico 46: Morphology and Color Patterns of a Dugès' Earth Snake (*Geophis dugesii* Bocourt, 1883) from the Municipality of Genaro Codina, Zacatecas, Mexico

Paulo Sergio Haro-Galván [1], Rogelio Rosas-Valdez [1], David Lazcano [2], Hugo Bernardo Ávila-Isáis [3], Lydia Allison Fucsko [4] and Larry David Wilson [5]

Introduction

Geophis dugesii is a dipsadid snake species endemic to Mexico, and distributed throughout the Sierra Madre Occidental to west-central Mexico (Lemos-Espinal and Smith, 2007; 2009; Lemos-Espinal et al., 2015; Heimes, 2016) in the states of Aguascalientes, Chihuahua, Durango, Guanajuato, Jalisco, Michoacán, Nayarit, Sinaloa, and Zacatecas. The species can be found at elevations between 1500 and 2502 meters above sea level (Arenas-Monroy et al., 2012; Wilson and Townsend, 2007). These snakes are not easy to observe in the field due to their fossorial habits and possible nocturnal behavior. They live in leaf litter in oak and pine forest, and are often found under rocks (Lemos-Espinal and Smith, 2007; Vázquez-Díaz and Quintero-Díaz, 2005). Diet includes earthworms and probably other small invertebrates. The IUCN Red List conservation status for *Geophis dugesii* is Least Concern (IUCN, 2023) and its Environmental Vulnerability Index (EVS) (*sensu* Wilson et al., 2013) is 13, placing it in the medium vulnerability category. *Geophis dugesii* is not included in the official Mexican listing of species at risk (SEMARNAT, 2010).

Distributional record and description of specimen

On 26 August 2017 a specimen of *G. dugesii* was found dead on the bank of the San Pedro River at south of the town of Genaro Codina (500 m), in the municipality of Genaro Codina. The collecting location coordinates are 22.47943°N, 102.4516°W, WGS 84 and elevation of 2127 meters above sea level. The specimen (CVZH-0523) is deposited in the Vertebrate Collection of Zacatecas (section of amphibians and reptiles [CVZH]). Identification of the specimen was verified by Jesús Sigala-Rodríguez, curator of the herpetology area of the zoological collection of the Universidad Autónoma de Aguascalientes. A morphological comparison of the characteristics of the collected specimen was made with those reported for the holotype of *G. dugesii* from Chihuahua, Mexico (Legler, 1959) and a color description of the specimen was made based on Köhler (2012).

The specimen presents the following size and meristic characteristics: SVL= 32.90 cm, tail length= 8.90 cm, and the following morphological features: 168 ventral scales; 58 subcaudal scales; 15 rows of dorsal scales throughout; supraocular scale distinct; loreal scale present; postocular single; anterior temporal scale absent; six supralabials present.

The color characteristics of the specimen are: rostral and prenasal scales jet black (color code 300), similar to that of adjacent scales; six supralabial scales (pale neutral gray [color code 256] and jet black); distinct internasals and a dark color patch on the chin. Along the body it has an alternation of rings between four and five ventral scales in length, numbering 35 dark (jet black) and 34 pale (pale neutral gray). The rings darken in the tail. The dark rings are thinner ventrally, mostly two to three ventral scales wide; the seventh dark band is incomplete ventrally (Figure 1). The light bands ventrally are smoke gray (color code 266).

Background on the study site

The municipality of Genaro Codina belongs to the state of Zacatecas, Mexico, located in the biogeographic provinces of the Chihuahuan Desert and Sierra Madre Occidental (INEGI-CONABIO-INE, 2008; Morrone, 2017), in the southeastern sector of the state, between 22°17'00" and 22°38'00" north latitude, and between 102°21'0" and 102°45'00" west longitude, with altitudinal range between 2000 and 3100 meters above sea level. This municipality, 797 km^2 in area, is bordered on the north by the municipalities of Villanueva, Zacatecas, and Guadalupe, on the east by Ojocaliente and Cuauhtémoc and on the south by the state of Aguascalientes. Xerophilous scrub vegetation predominates in low areas and pine-oak forests in high areas belonging to the Sierra Fría region. This municipality has a temperate semi-dry climate, with an average annual temperature of 18°C and precipitation of 400 to 800 mm per year (INEGI, 2005).

The locality where the snake was found presents a steep area where xerophilous scrub vegetation predominates, and the site where the snake was found is a stream bordered by gallery forest. The predominant tree species is *Salix bonplandiana* (Bonpland willow) and the shrub layer around the stream is mainly represented by the species *Buddleja cordata* (tepozan) and *Baccharis salicifolia* (mulefat). In addition, some aquatic or underwater plants such as *Nasturtium officinale* (watercress) were recorded within the body of water (Figures 2 and 3). Vegetation was identified based on Rzedowski (2006).

Discussion and Conclusions

The locality of the specimen reported herein is outside of the distributional range of *Geophis dugesii* (Figure 4). Some authors

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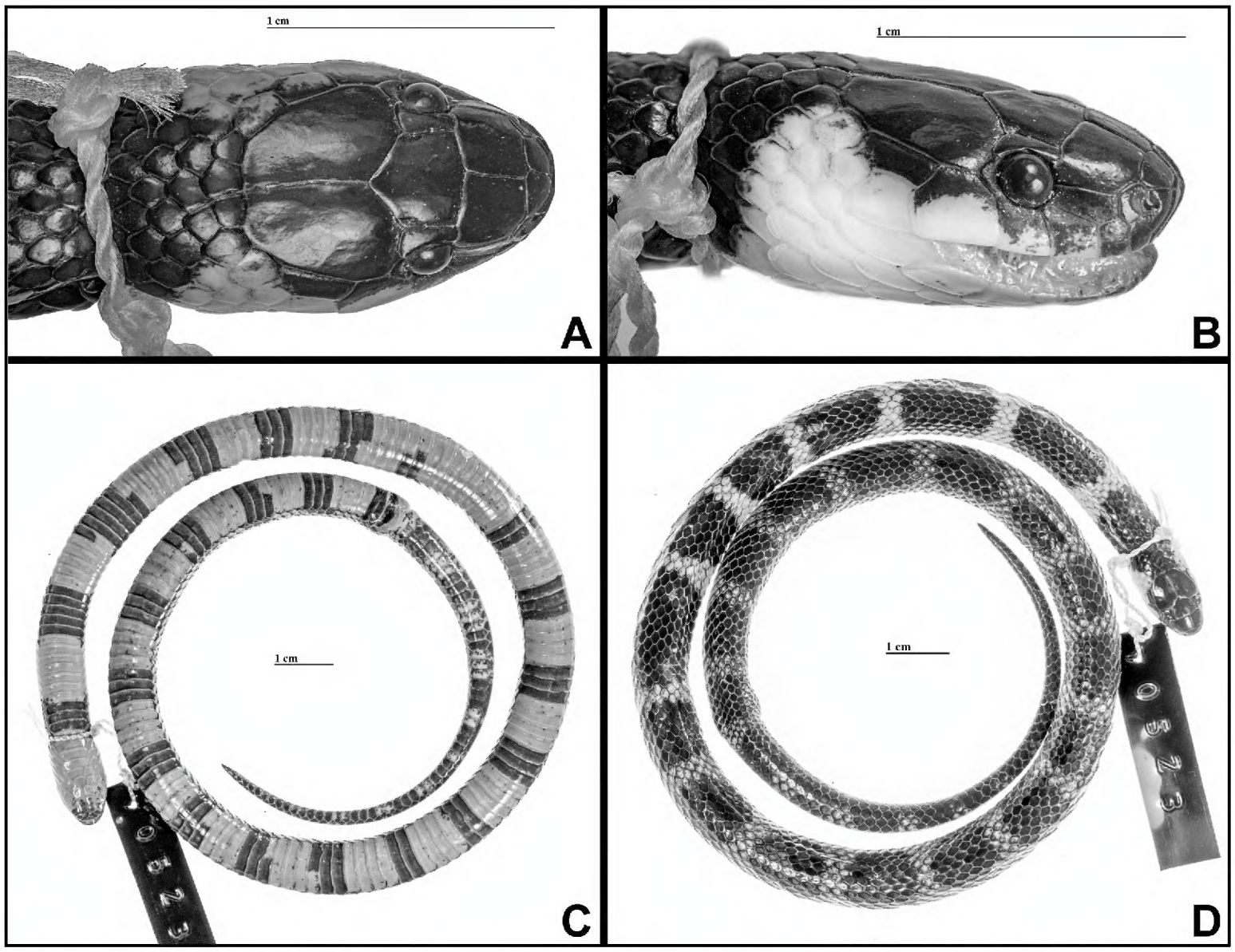

Figure 1. Four views of the specimen of *Geophis dugesii* (CVZH-0523) from the municipality of Genaro Codina, Zacatecas, Mexico: **A**) Dorsal view of the head and the parietal and nasal scales; **B**) Lateral view of the head; **C**) Venter, showing dark rings of two to three scales in width, and the incomplete seventh ring; **D**) Dorsum, with dark rings wider than on the venter. All photographs by Daniel Ochoa-Vázquez.

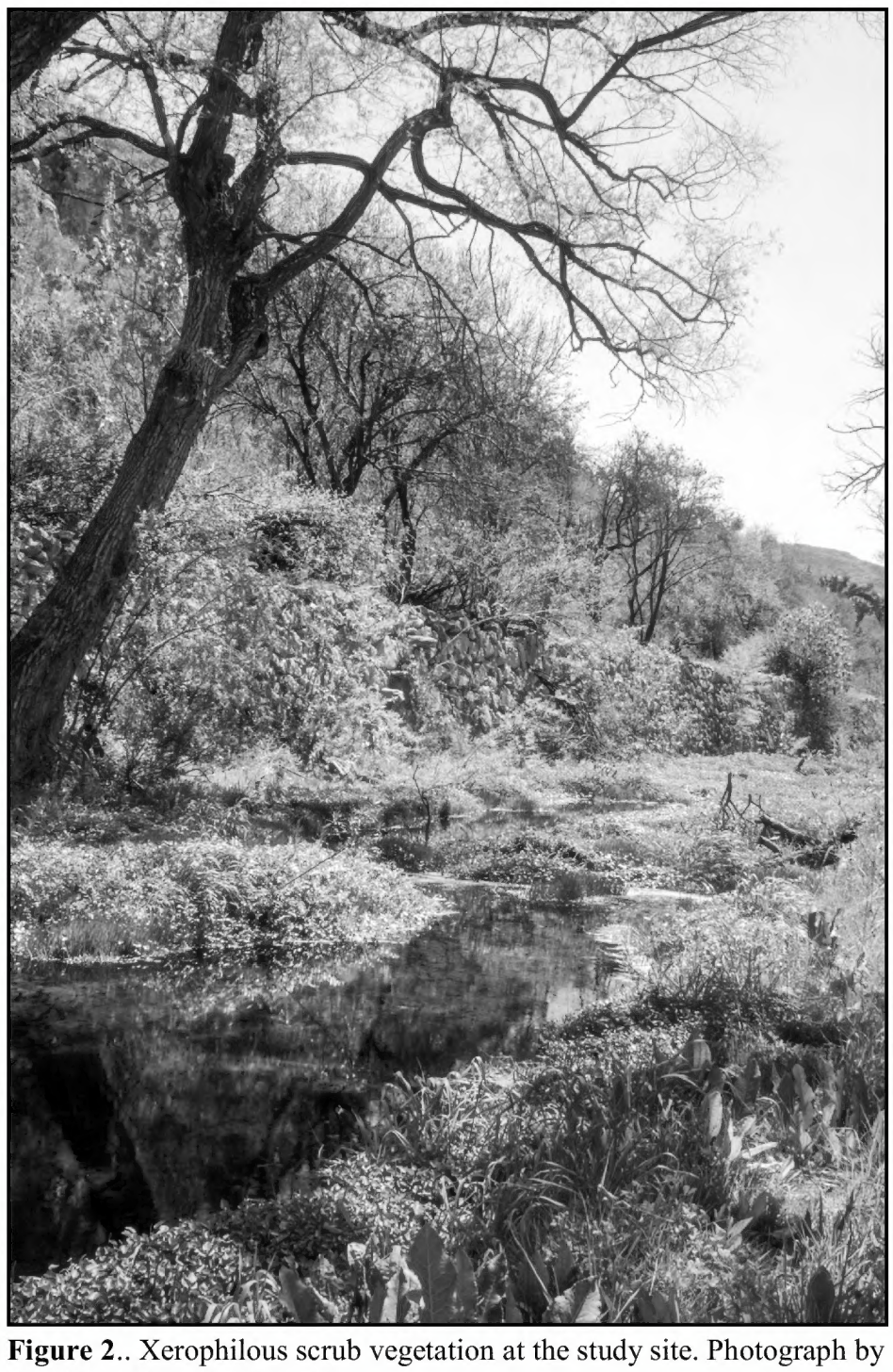

Figure 2.. Xerophilous scrub vegetation at the study site. Photograph by José Miguel Cortés-Gaytán.

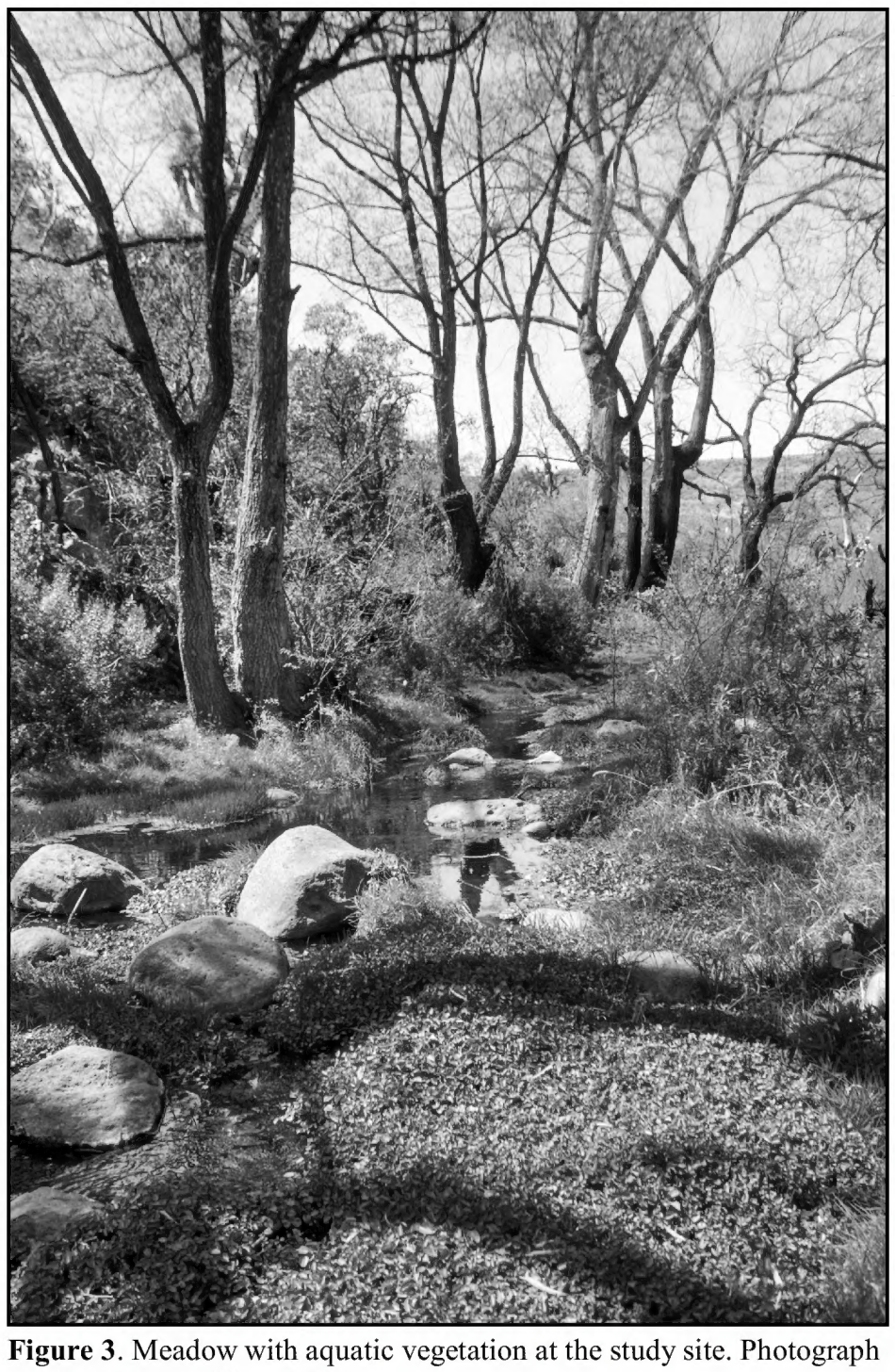

Figure 3. Meadow with aquatic vegetation at the study site. Photograph by Paulo Sergio Haro-Galván.

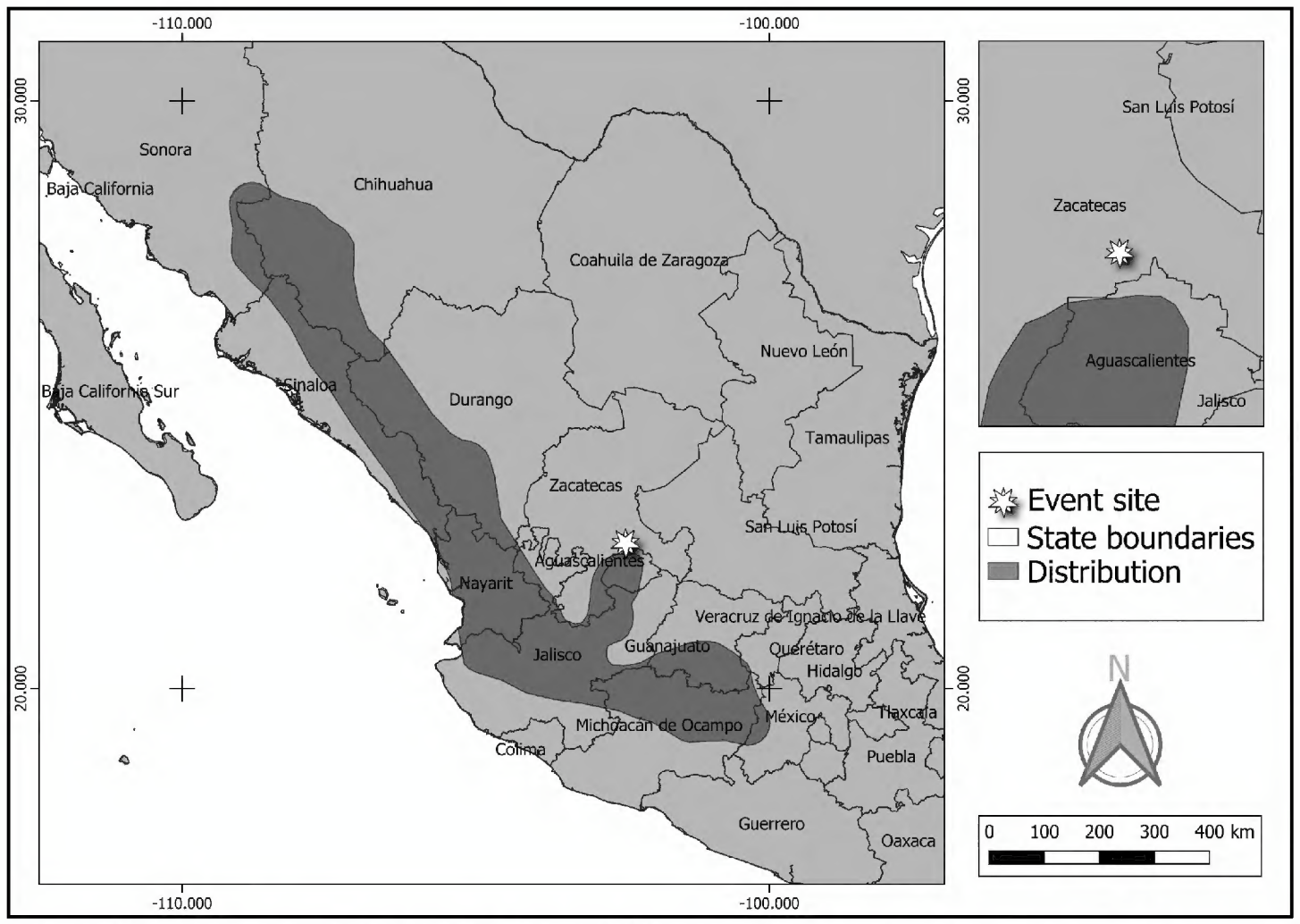

Figure 4. Potential distribution of *Geophis dugesii* in Mexico and locality where the Zacatecan specimen was collected. Map created by Edgar Emmanuel Hernández-Juárez.

(Webb 1977; Heimes 2016) consider that *G. dugesii* comprises two subspecies, *G. d. aquilonaris* Legler 1959 and *G. d dugesii* Bocourt 1883. Webb (1977) pointed out that specimens from Durango and Sinaloa are intermediate between the two subspecies, supporting the concept of a single species. Irrespective of how these taxa are recognized, they do differ in features of scutellation and color pattern (Heimes, 2016). Table 1 compares morphological data of the Zacatecas specimen reported here with the generic revision of Downs (1967) in which *G. aquilonaris* and *G. dugesii* (as *G. dugesi*) were considered independent species. Those two species share the following features with the Zacatecas specimen: a) a single loreal, supraocular, and postocular, and lacking an anterior temporal b) six supralabials, with the third and fourth entering the orbit c) dorsal scales smooth and in 15 rows throughout the body. These features are consistent with the *chalybeus* group of Downs (1967), which included six species, i.e., *G. aquilonaris*, *G. bicolor*, *G. chalybeus*, *G. dugesi*, *G. nigrocinctus*, and *G. tarascae*. However, some features lie intermediate between the values for males of *G. aquilonaris* and *G. dugesi* (*sensu* Downs [1967]), particularly the ventral, subcaudals and their total sum (Table 1). The color pattern of the Zacatecan specimen of 22 neutral gray body rings and 12 neutral gray tail rings more closely resembles that of *G. aquilonaris* (29–39 light rings on body and 12–17 on tail) than

Table 1. Comparisons among Zacatecan specimen (CVZH-0523) and the data of Downs (1967) on *Geophis aquilonaris* and *Geophis dugesi*.

Characteristics	**CVZH-0523**	***Geophis aquilonaris***	***Geophis dugesi***
Loreal	Single	Single	Single
Supraocular	Single	Single	Single
Anterior temporal	Absent	Absent	Absent
Supralabials	6 (3&4 entering orbit)	6 (3&4 entering orbit)	6 (3&4 entering orbit)
Postocular	Single	Single	Single
Dorsal scale rows	15-15-15	15-15-15	15-15-15
Condition of dorsal scales	Smooth throughout body	Smooth throughout body	Smooth throughout body
Ventrals	168 (male)	172–185 in males; 173–183 in females	150–162 in males; 160–164 in females
Subcaudals	58 (male)	59–66 in males; 55–63 in females	41–43 in males; 37–39 in females
Total ventrals and subcaudals	226 (male)	228–246	192–204
Color pattern of body and tail	35 jet black rings; 34 neutral gray rings	Alternating dark and light rings; usually complete across venter	Dorsal color pattern highly variable; ground color brownish or bluish-black; ventrals creamish or white, immaculate.
Color pattern of body	23 jet black rings; 22 neutral gray rings	29–39 light rings on body	0–7 narrow light crossbands on anterior part of body
Color pattern of tail	12 jet black rings; 12 neutral gray rings	12–17 light rings on tail	Subcaudals predominantly whitish, with dark mottling scattered or concentrated in midventral area

G. dugesi (with light rings limited to anterior portion of body).

Given the features described above for the Zacatecan specimen, and those presented by Downs (1967) for *G. aquilonaris* and *G. dugesi*, the Zacatecan specimen can be identified as *Geophis dugesii*, but the intermediate features suggest that more specimens are desirable to confirm that *G. aquilonaris* and *G. dugesi* (*sensu* Downs [1967]) are conspecific.

Acknowledgments

We thank Daniel Ochoa-Vázquez for taking photographs of the preserved specimen and José Miguel Cortés-Gaytán for the photographs of the site. Research was authorized by SEMARNAT (OFICIO NUM/SGPA/DGVS/11906. 2017) in order to collect any DORs or dead *in situ* found throughout the state. We also are grateful to Peter Uetz for help with some literature.

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Notes on the Herpetofauna of Nayarit, Mexico 7: New Geographical Record for the Smooth-backed Frog (*Rana psilonota*) in Nayarit, Mexico

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Introduction

Knowledge of the geographical ranges of amphibians and reptiles in Nayarit, Mexico, has increased continuously over the past decade, with numerous range extensions and new municipality records published (e.g., Loc-Barragán and Carbajal-Márquez, 2016; Loc-Barragán et al., 2016a, b, c, d, e, f, g, h; 2017; 2018a, b; Loc-Barragán and Barrio-Amorós, 2018; Loc-Barragán, 2019a, b; Loc-Barragán, 2020). Here we report a new municipality record for *Rana psilonota* (Smooth-backed Frog), which also expands its known range.

Rana psilonota is a member of the family Ranidae, described in 2001 by Robert Webb, with type locality 9.6 km N of Santa Isabel, Municipality of Ahuacatlán, Nayarit (Webb, 2001). As currently understood, this frog's distribution is in western Mexico, from southern Nayarit, northern Aguascalientes and southern Zacatecas, through western Jalisco to northwestern Colima. It is associated with tributaries of the Río Ameca, Río Armería and Río Grande de Santiago (Webb, 2001). Ahumada-Carrillo et al. (2011) provided the first record of this species in Zacatecas from the Municipality of Mezquital del Oro, thus filling a distributional gap between Aguascalientes and Jalisco. Bañuelos-Alamillo et al. (2018) later reported an additional locality for Zacatecas from the Municipality of Valparaíso. The frog's known elevation range is from 350 to 2400 masl.

According to the IUCN Red List, the conservation status of *R. psilonota* is "LC = Least Concern" (Grünwald et al., 2020). Under Mexican wildlife law, the species is categorized as NL (= "not listed") (SEMARNAT, 2019). The species has an environmental vulnerability score (EVS, *sensu* Wilson et al., 2013) of 14, which places it in the high vulnerability category.

Distribution Record

Mexico: Nayarit: Municipio de Santa Maria del Oro: La Labor, Manantial de Acuña (21.349477°N, 104.702918°W; datum = WGS 84; 1187 m elev.). 25 June 2023. Photographed by Jesús A. Loc-Barragán, identification verified by Paulino Ponce-Campos. A photo voucher of the individual was deposited in the Colección Herpetológica, Universidad Michoacana (CHUM-F419). The frog was observed sitting under water within a spring in tropical deciduous forest. We recorded size and environmental parameters and then released the specimen at the observation site. The measurements recorded were: head width (28.0 mm); head length (26.0 mm); snout–vent length (70.5 mm); length of thigh + tibia (35.8 mm); length of foot + metatarsus (38.1 mm); forelimb (49.9 mm); tympanum (4.6 mm); eye (7.3 mm); weight (41 g); body temperature (27.6°C); air temperature (27.2°C); water temperature (23.7°C). The frog was observed in a spring (Manantial de Acuña) that feeds the Mololoa River, Nayarit, in Tropical Deciduous Forest vegetation. This observation was added to the iNaturalist platform as: https://mexico.inaturalist.org/observations/170234876.

Smooth-backed frog (*Rana psilonota*) from Municipio de Santa Maria del Oro, Nayarit, Mexico. Photograph by Jesús A. Loc-Barragán.

Discussion

This report represents a new municipality record and a range extension of ca. 22 km NW (airline distance) from the closest known at 9.6 km N of Santa Isabel, Municipality of Ahuacatlán, Nayarit (Type material: Adult Female; Original field number, RGW 4727: MSUM 12908, Webb, 2001) and 47 km SW (airline distance) from the other known Nayarit locality at La Yesca, Sierra de Alica (UTA 56778; with record of 14 June 2003 by Jonathan Campbell: In Canseco-Márquez et al., 2007: GBIF, 2023). The record reported here makes three localities known so far for Nayarit, and defines in more detail the distribution of *Rana psilonota*, as occurring along the foothills of the western limits of the Trans-Mexican-Neovolcanic geological subprovince.

Acknowledgments

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Book Review: *Frog Day: A Story of 24 Hours and 24 Amphibian Lives* by Marty Crump, illustrated by Tony Angell. 2024. 200 pp. The University of Chicago Press. ISBN: 13-978-0-226-83020-9. Hardcover $18.00 (pre-order price)

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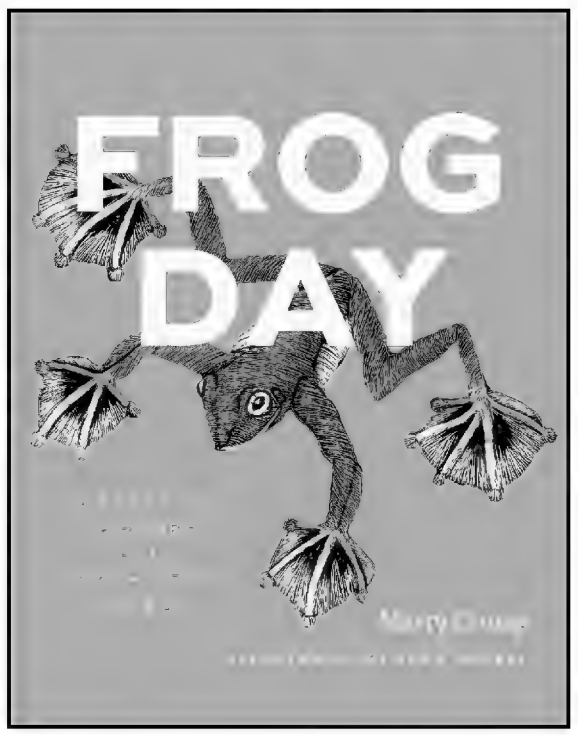
In my mind, the name Marty (Martha) Crump is synonymous with frogs, especially those of the New World tropics. As a graduate student at the University of Kansas, Dr. Crump studied the myriad reproductive strategies of frogs at Santa Cecilia, Ecuador, during the early 1970s. In addition to publishing the results of her dissertation in the scientific literature (Crump, 1974), she also summarized her work in an article written for lay persons (Crump, 1977). This latter work is how I became familiar with Dr. Crump several decades ago. I had the good fortune to meet and talk with her at a herpetological meeting many years later, an interaction she no doubt does not remember. Some of you may recall that she came to Chicago to speak to the Chicago Herpetological Society membership in 2016 (Archer, 2016). Given her knowledge of frogs and her ability as a writer, when our esteemed editor, Mike Dloogatch, offered me the opportunity to review Dr. Crump's latest book, I could not refuse him.



Frog Day is the second in a series of "Earth Day" books by the University of Chicago Press. Other titles include *Bird Day: A Story of 24 Hours and 24 Avian Lives* by Mark Hauber, published in 2023, and *Flower Day: A Story of 24 Hours and 24 Floral Lives* by Sandra Knapp, scheduled for publication in 2025. At the University of Chicago Press website, these Earth Day books are described as "windows to witness the diversity of life."

Physically, the hardback book is 6.25 inches tall, 5 inches wide, and 1 inch thick. It consists of 182 numbered pages, as well as a Table of Contents, Preface, Artist's Note, Epilogue, Acknowledgments, Further Reading, and an Index. The typeface is relatively large, resulting in an easier read for younger and older readers alike. Although written for the layperson, I suspect that frog biologists will learn something as well. *Frog Day* includes 24 black-and-white, pen-and-ink illustrations by Tony Angell, an artist from Seattle, Washington. One of Angell's skillfully created frog depictions graces the beginning of each species account. Angell's work can be admired at his website, www.tonyangell.net.

Frog Day is a compilation of vignettes, illuminating interesting aspects of the natural history of 24 species of frogs encountered by the writer and us—the readers—over the course of a single day. That is, at top of each hour of one fictitious day, Crump introduces the reader to a different species of frog. She writes as if we are accompanying her in the field, witnessing firsthand what she sees. I am reminded of another frog enthusiast, Mary Dickerson, who also brought the reader along on several pleasant field excursions in *The Frog Book* (1969).

Crump opens the Preface with this statement, "What do frogs do all day long?" The book, of course, answers that question for two dozen species. Crump introduces herself to the reader and writes, "One of the thrills of being a field biologist is discovering previously unknown behaviors." She discusses the diversity of frogs (7642 species worldwide at the time she wrote the book), their uneven distribution around the world, and their importance to the ecosystems in which they occur. She also touches on the plight of frogs in a human-dominated world.

Our day with the author begins at midnight in a humid Indonesian rainforest. In an instant, a Wallace's Flying Frog (*Rhacophorus nigropalmatus*) glides by us, "caught in our headlight beams." And thus begins our whirlwind adventure across the planet, carried by Crump's engaging writing style, in which she introduces us to frogs on six continents. We are presented with accounts of frogs with unique survival strategies such as those that can nearly freeze solid during winter, those that employ tarantulas as bodyguards, those that avoid predators by mimicking bird droppings, those that gorge on cat or dog food in outdoor pet bowls, those that can survive a year without feeding, and those that produce a sticky substance that can glue a predator's mouth shut. We also learn about frogs that store so much water in their bodies that they can be gently squeezed to provide a person with an emergency drink (imagine that!) We meet frogs that grow no larger than a lima bean and others that weigh in at three pounds. We also become acquainted with frogs having unique breeding behaviors such as attracting mates by waving their feet or those that change their breeding call depending upon whether they are vocalizing alone or in the presence other males. In addition, we learn about frogs that brood their young in their vocal sacs or frogs that carry their young in pouches on their back. We are also introduced to frogs that were the first vertebrates to be cloned. So many remarkable frogs in the world, and we meet but 24 in this book.

In the Epilogue, Crump alludes to the difficult dilemma she faced when selecting which frogs to include in the book, and briefly describes the captivating lives of several excluded species. And she shares the sobering fact that 41% of amphibian species are threatened with extinction. For readers wishing to learn more about frogs, Crump provides 14 titles to consider

reading. She also provides titles of peer-reviewed papers for every frog species addressed in her book.

Frog Day is a delightful, entertaining read, and a pleasant way to spend a few hours. Marty Crump's fascination with frogs is undeniable, and her enlightening prose leaves the reader craving more. I hope that The University of Chicago Press will consider making *Frog Day* into a series of books. And I hope *Frog Day* will inspire readers to familiarize themselves with the fascinating lives of their local frogs, and work to conserve the places they live.

Acknowledgement

I thank Mike Dloogatch for the opportunity to review *Frog Day*.

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Herpetology 2024

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

GRASPING IN TREEFROGS

M. J. Cannata et al. [2024, Journal of Herpetology 58(1):64-74] note that arboreal habitats provide expanded niches for species by offering access to new food sources and providing safety from predators. To securely navigate these challenging 3-D environments, treefrogs generate gripping forces using both active muscle recruitment and passive mucus adhesion mechanisms to maintain contact with the substrate and prevent falling. This study focused on Australian green treefrogs (*Ranoidea caerulea*) as a model for exploring grasping abilities in an arboreal context. Using a portable grip strength tester, the authors collected pulling forces from five animals (mean body mass: 34.1 ± 7.6 g) across five different substrate diameters (2.5, 5.0, 7.5, 10.0, and 12.5 mm). Their findings revealed that mucus adhesion accounts for approximately 75% of pulling forces, as indicated by a significant reduction in force when using an oiled substrate. Additionally, hindlimbs exhibit greater pulling forces than forelimbs, which is consistent with the larger size and primary propulsive function of hindlimbs in anurans. They also observed a decrease in force generation on larger diameter substrates, which was likely due to length-tension properties of the flexor musculature. Comparisons with other arboreal species demonstrated that treefrogs exhibit similar relative pulling strengths. Mucus adhesion represents a crucial mechanism facilitating movement on arboreal supports, allowing amphibians to navigate arboreal substrates without extensive anatomical adaptations. Further comparative studies across diverse anuran taxa are needed to explore the role of hindlimb morphology in grasping adaptations. Understanding the interplay between active muscle recruitment and mucus adhesion mechanisms will provide valuable insights on evolution of grasping abilities in arboreal tetrapods.

NILE MONITOR DISTRIBUTION MODELS

H. R. Bevan et al. [2024, Journal of Herpetology 58(1):16-27] note that nonnative species mitigation is important to conserve Florida's native wildlife, especially with nonnative reptiles such as Nile monitors (*Varanus niloticus*). Nile monitors are habitat and dietary generalists in their native (Africa) and nonnative (Florida) ranges and were introduced to Florida in the early 1990s through the pet trade. Nile monitors have since become established in three coastal counties in southern Florida. Confirmed sightings extend beyond established Nile monitor populations into parts of central and northern Florida, but it is unclear whether spread is likely to these areas or even into surrounding states. Mitigation strategies to locate, remove, and proactively prevent introduction and spread of nonnative species include species distribution models (SDMs). Two Nile monitor SDMs currently exist but are not at an appropriate scale to inform regional management practices and include various methods that do not meet current model quality standards. Nile monitor SDMs here represent high-quality, region-scale predictions at a 1 km^2 resolution fitted with ensembles of algorithms, 14 predictors (including environmental and anthropogenic variables), and occurrence data from both the native and nonnative ranges. Final SDM predictions indicate little habitat suitability and low probability of spread beyond the central region of Florida, contradictory to existing Nile monitor SDMs. Pathways of suitable habitat exist from established populations into other central and southern parts of Florida along coastlines and suggest possible anthropophilic habitat preferences that will require further telemetric behavioral studies to validate.

A NEW FOSSIL ANOLE IN HISPANIOLAN AMBER

K. de Queiroz et al. [2024, Journal of Herpetology 58(1):75-82] note that pre-Pleistocene fossils of *Anolis* lizards are rare, although 20 Miocene fossils preserved in amber from the island of Hispaniola have been reported on previously. Using light-microscopy and computed-tomography imaging, the authors studied a new amber fossil *Anolis* lizard from Hispaniola. The fossil is likely a juvenile and preserves a largely intact left forelimb, including both scales and skeletal elements, as well as some additional skin, skin impressions, and fragmentary skeletal elements from other parts of the body. Using measurements and lamella counts from the forelimb of the fossil and other juvenile anoles, discriminant function analysis and three Euclidean-distance criteria derived from a principal components analysis consistently support classification of the fossil as a member of the trunk ecomorph category, and those results, in combination with two scale characters preserved in the fossil, suggest that it is a member of the *Anolis distichus* series within the *Ctenonotus* clade. These results represent only the third case of a well-supported assignment of an *Anolis* fossil to the trunk ecomorph category and the first to the *A. distichus* series. They also highlight that such assignments can sometimes be inferred from highly incomplete fossils.

SALAMANDER COURTSHIP AND MATING BEHAVIOR

G. A. Marvin [2024, Ichthyology & Herpetology 112(2):238-256] describes courtship and mating of the plethodontid salamander *Plethodon petraeus* (Pigeon Mountain salamander), which is a member of the *P. glutinosus* group (PGG) of eastern species of *Plethodon* (EP). Individuals exhibit adaptions for enhanced climbing ability and inhabit moist crevices of rock outcrops and cave openings within a very limited range in northwestern Georgia (USA). Courtship involves a unique blend of behaviors known for species in the PGG, *P. cinereus* group (PCG), and *P. welleri* group (PWG) of EP. Compared to most species in the PGG, there are notable differences during both the tail-straddling walk (TSW) and the period that precedes the TSW ("pre-TSW phase"). Males exhibit both "foot dance" and "foot shuffle." Frequent, high-amplitude mental-gland "popping" by males during mental-gland sliding may be due to more-adhesive skin or mental-gland secretions. Olfactory delivery of pheromones is absent or rare because mental-gland contact to the female's nares is absent or very infrequent during the pre-TSW phase and absent (or rare) during the TSW. Two forms of the duet behavior "female-first tail-straddling walk" (ffTSW) occur during the pre-TSW phase: a discontinuous form during most courtships and a continuous form during some courtships. Infrequent "mouth grasping" by males may be a facultative behavior that promotes transdermal pheromone delivery to less-receptive females. Very similar to some species in the PCG and PWG, the female initiates contact leading to the TSW in most courtships via turning back during ffTSW. If mating occurs within the protection of rock crevices, then reduced predation pressure or mate competition may have permitted the evolution of the relatively prolonged courtship (mean about 5 h). The results here indicate that the detailed study of additional species will help refine current ideas about the evolution of courtship behavior in EP and perhaps other plethodontid clades.

DETECTION OF EASTERN MASSASAUGAS

J. D. Choquette et al. [2024, Herpetologica 80(3):262-274] note that standardized estimates of a species' distribution before and after translocation can inform whether a reintroduction project was effective at population establishment. Occupancy modeling has grown in popularity to estimate the distribution of cryptic animals, including viperid snakes, because it can account for variations in detection probability (P) generated by site-, survey- and population-specific factors. The authors estimated occupancy and P in an endangered subpopulation of the cryptic North American pit-vipers (eastern massasaugas, *Sistrurus catenatus*; hereafter massasauga[s]) in preparation for future conservation translocations. During a 6-yr period at the Ojibway Prairie Complex and Greater Park Ecosystem, in Ontario, Canada, the authors conducted more than 1740 repeated standardized surveys at 40 plots (each ca. 2.4 ha) by using two methods (visual encounter and artificial cover object), across three seasons (spring, summer, and fall), and with different types of search effort (single vs. team surveys) and analyzed a suite of detection histories by using occupancy modeling. Massasaugas were detected at only 10% of survey sites (n = 4/40), and the species was presumed undetected at one additional site after accounting for P (estimated occupancy, 13%). The P for massasaugas ranged from 0.01 to 0.73 and was most strongly influenced by search effort, season, and trap response (i.e., "trap-happy" individuals repeatedly found in the same locations). The detection probability was significantly inflated during surveys when there was at least one trap-happy snake present. Across top ranking models (based on Akaike's Information Criterion scores), team visual encounter surveys in spring and summer, and conducting at least two surveys per week, generated an average $P = 0.15$ after accounting for a trap response. Conversely, fall surveys and artificial cover object surveys generated a $P < 0.15$. The study provides direction to other conservation practitioners working with small populations of cryptic snakes and will inform monitoring regimes for future conservation translocations.

GENE FLOW IN TIMBER RATTLESNAKES

A. M. Royer et al. [2024, Ichthyology & Herpetology 112(2): 144-152] report that, threatened across much of their range, timber rattlesnakes (*Crotalus horridus*) exhibit patterns of genetic diversity that are shaped by movement and aspects of their environment in ways that may foster or constrain conservation. They combine movement data with nuclear and mitochondrial population genetic data to understand the population structure and patterns of gene flow for snakes in four overwintering sites (hibernacula) in central Pennsylvania. Their analyses show that hibernacula separated by only a few kilometers can maintain genetic structure along with high gene flow. Female spatial use rarely overlapped with individuals from adjacent hibernacula, whereas male spatial use typically did overlap with individuals from adjacent hibernacula. This study offers new evidence for how asymmetry in gene flow (with males responsible for inter-hibernaculum matings) shapes timber rattlesnake population genetics.

UPCOMING MEETINGS

The first CHS monthly meeting at our new time and place will start at 7:00 P.M. on Wednesday, September 18, at the Elgin Math and Science Academy (EMSA), 1600 Dundee Avenue (IL-25), Elgin, Illinois. Please try to join us. **Myke Clarkson** will provide a virtual presentation on aquatic snakes. Myke is a natural history filmmaker and television producer who currently serves as president of two nonprofits: the International Herpetological Symposium and Herpetological Conservation International. He is the author of several chapters in *Aquatic Snakes: Diversity and Natural History*, edited by John C. Murphy.

Allison Sacerdote-Velat, curator of herpetology at the Peggy Notebaert Nature Museum, will be our speaker at the October 30 meeting.

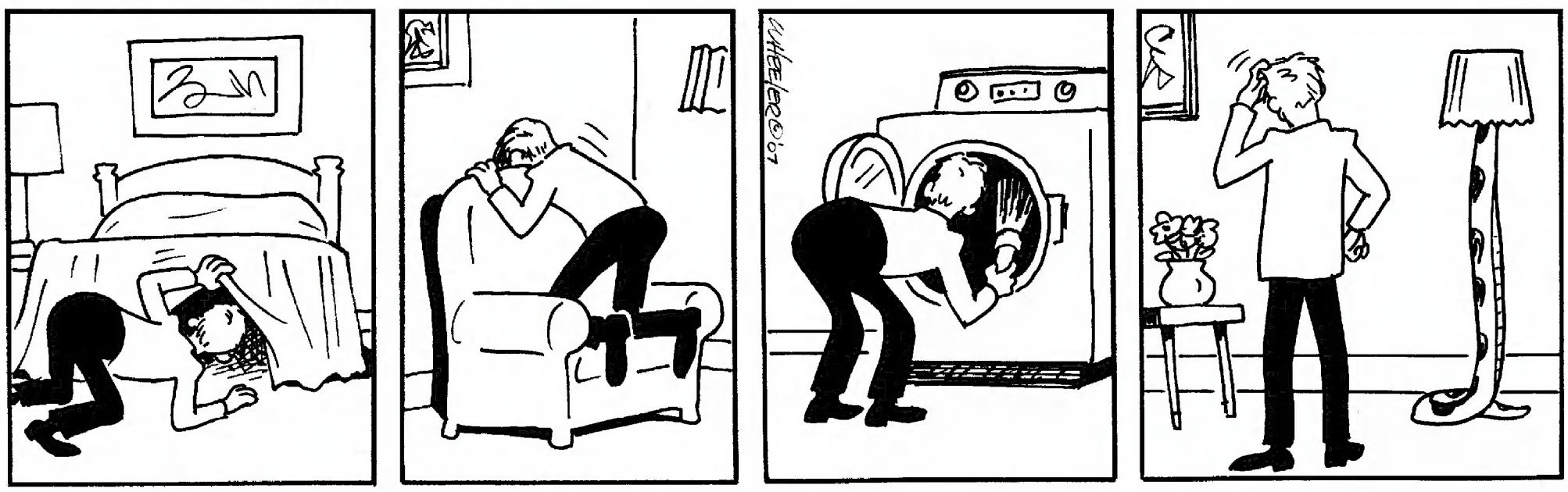
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting will be held at EMSA. If you wish to attend in person or via Zoom, please email: rcrowley@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

Megan Rons
Clint Gross
Abigail O'Connor

THE ADVENTURES OF SPOT



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